

CLAIMS

1. Method of turbocoding for the transmission of information in
 5 which, a first polynomial with binary coefficients $g(x)$ of degree d and with a constant term equal to 1 having been predetermined, first of all said information is presented in the form of binary sequences \underline{u} of length

$$k = p - d,$$

- where p is a predetermined multiple of the period N of the polynomial $g(x)$, and
 10 then, for each of said sequences \underline{u} , there is produced a triplet \underline{v} of binary sequences $(\underline{a}, \underline{b}, \underline{c})$ intended to be transmitted and obtained as follows:

- said sequence \underline{a} is of length p and obtained by extending the sequence \underline{u} by means of d "padding" bits so that the polynomial

$$a(x) = \sum_{i=0}^{p-1} a_i x^i$$

- 15 associated with \underline{a} is divisible by $g(x)$,

- said sequence \underline{b} is represented by the polynomial

$$b(x) = a(x) \cdot f_1(x) / g(x),$$

where $f_1(x)$ is a second polynomial with predetermined binary coefficients, without a common divisor with $g(x)$, and

- 20 - said sequence \underline{c} is represented by the polynomial

$$c(x) = a^*(x) \cdot f_2(x) / g^*(x),$$

where

$$a^*(x) = \sum_{i=0}^{p-1} a_i x^{\pi(i)},$$

- where $\pi(i)$ is a predetermined permutation of the integers i lying between 0 and
 25 $(p-1)$, where $g^*(x)$ is a third polynomial with predetermined binary coefficients, of degree d and with a constant term equal to 1, $\pi(i)$ and $g^*(x)$ being chosen so that, whatever the polynomial $a(x)$ divisible by $g(x) \pmod{2}$, $a^*(x)$ is divisible by $g^*(x) \pmod{2}$, and where $f_2(x)$ is a fourth polynomial with predetermined binary coefficients, without a common divisor with $g^*(x)$,

characterized in that there is taken for $\pi(i)$ the residue modulo p of the product $(i \cdot e)$, where e is a predetermined strictly positive integer, relatively prime with p , congruent with a power of 2 modulo N , and not congruent with a power of 2 modulo p , from which it results that $g^*(x)$ is identical to $g(x)$.

5 2. Turbodecoding method, characterized in that it makes it possible to decode received sequences which have been transmitted after having been coded by means of a turbocoding method according to Claim 1.

3. Method for determining a turbocoding method in which, a first polynomial with binary coefficients $g(x)$ of degree d and with a constant term equal to 1 having been predetermined, first of all said information is presented
10 in the form of binary sequences \underline{u} of length

$$k = p - d,$$

where p is a predetermined multiple of the period N of said polynomial $g(x)$, and then, for each of said sequences \underline{u} , there is produced a triplet \underline{v} of binary
15 sequences $(\underline{a}, \underline{b}, \underline{c})$ intended to be transmitted and obtained as follows:

- said sequence \underline{a} is of length p and obtained by extending the sequence \underline{u} by means of d "padding" bits so that the polynomial

$$a(x) = \sum_{i=0}^{p-1} a_i x^i$$

associated with \underline{a} is divisible by $g(x)$,

20 - said sequence \underline{b} is represented by the polynomial

$$b(x) = a(x) \cdot f_1(x) / g(x),$$

where $f_1(x)$ is a second polynomial with predetermined binary coefficients, without a common divisor with $g(x)$, and

- said sequence \underline{c} is represented by the polynomial

25 $c(x) = a^*(x) \cdot f_2(x) / g(x),$

where

$$a^*(x) = \sum_{i=0}^{p-1} a_i x^{\pi(i)},$$

where $f_2(x)$ is a third polynomial with predetermined binary coefficients, without a common divisor with $g(x)$, and where $\pi(i)$ is the residue modulo p of the
30 product $(i \cdot e^*)$, where e^* is a number determined in the following manner:

a) a certain number of different sequences \underline{u} are chosen to form what will be referred to as the "representative set",

b) for each strictly positive integer number e less than p , congruent with a power of 2 modulo N and relatively prime with p :

5 - the total binary weight PB of all said triplets of binary sequences \underline{v} associated with the sequences \underline{u} belonging to said representative set is calculated, and

 - note is taken of the value $w(e)$, associated with this value of e , of the minimum weight amongst all these binary weights PB , and

10 c) in order to implement the coding, the value e^* of e which is associated with the largest value of this minimum weight w is chosen.

4. Device (901) for coding sequences of data intended to be transmitted by means of a turbocoding method according to Claim 1, characterized in that it has:

15 - means (30) for obtaining, for each sequence of data \underline{u} , said sequence \underline{a} associated with \underline{u} by extending the sequence \underline{u} by means of said d padding bits, and

 - at least one turbocoder (40) having an interleaver π_1 able to effect the permutation provided for in said method.

20 5. Decoding device (1101) intended to implement a turbodecoding method according to Claim 2, characterized in that it has:

 - at least one turbodecoder (300) having two interleavers π_1 able to effect the permutation provided for in said method, and a deinterleaver π_2 able to reverse this permutation, and

25 - means (335) for producing a binary sequence $\hat{\underline{u}}$ by removing the last d bits of the estimated sequence $\hat{\underline{a}}$ obtained at the end of the turbodecoding of the received sequences \underline{a}' , \underline{b}' and \underline{c}' corresponding respectively to said transmitted sequences \underline{a} , \underline{b} , and \underline{c} .

30 6. Apparatus for transmitting coded digital signals (48), characterized in that it has a coding device according to Claim 4, and in that it has means (906) for transmitting said coded sequences \underline{a} , \underline{b} , and \underline{c} .

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7. Apparatus for receiving coded digital signals (333), characterized in that it has a decoding device according to Claim 5, and in that it has means (1106) for receiving said sequences a', b', and c'.

8. Telecommunications network, characterized in that it has at least one apparatus according to Claim 6 or Claim 7.

9. Data storage means which can be read by a computer or a microprocessor storing instructions of a computer program, characterized in that it makes it possible to implement a method according to any one of Claims 1 to 3.

10. Means of storing data which are removable, partially or totally, which can be read by a computer and/or a microprocessor storing instructions of a computer program, characterized in that it makes it possible to implement a method according to any one of Claims 1 to 3.

11. Computer program containing instructions such that, when said program controls a programmable data processing device, said instructions mean that said data processing device implements a method according to any one of Claims 1 to 3.

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